**Colorado Technical University**

**Course:** MATH207 – Integral Calculus

**Unit 4 Part 8 Readings: Differential Equations**

**Differential Equations (DE or DiffEq)**

Differential equations are used to change calculus back into algebra

Differential equations (DE) are used to describe any kind of a system that experiences an increase or decrease in energy.

The energy flow that is reflected in the DE may be of a type we cannot experience visually or by touch; an example of that kind of energy is electromagnetic energy, which is the driving force behind the entire communications industry, as well as all of the industries all over the world that use electrical power.

A differential equation can be used to describe any kind of a gradient

# Every voltage and current is the solution to a differential equation

**Order of a DiffEq**

A first order system has one form of energy stored or released, and the equation will contain the first derivative only of the dependent variable

A second order system has two forms of energy stored or released, and the equation will contain the second derivative of the dependent variable

Example:

The seawater DiffEq has 14 variables including temperature, tide, wave motion, salinity, depth, weather conditions, impurities, etc. and contains a 14th derivative of the major variable

We say that seawater DiffEq is 14th order

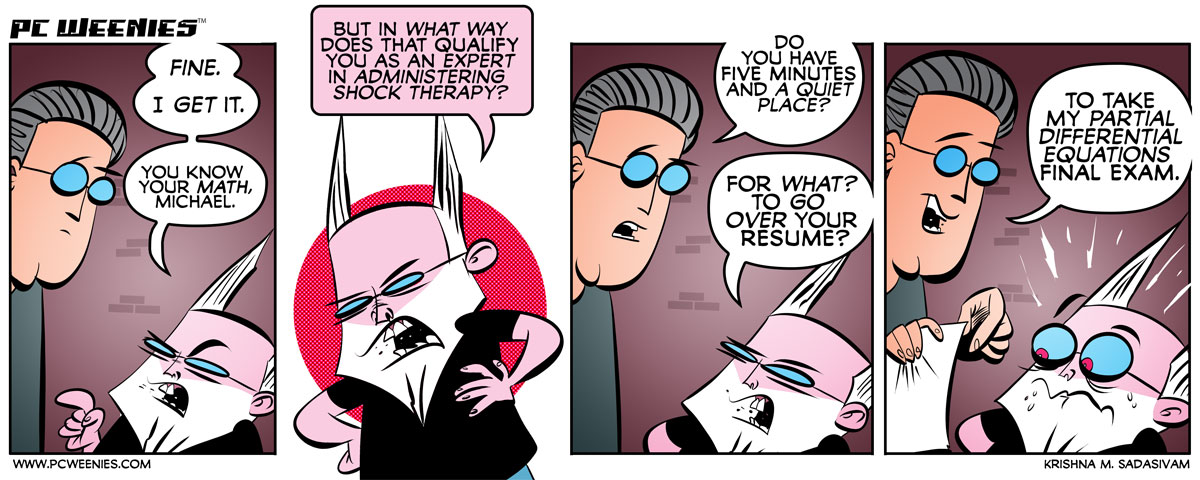
*y* =  + *x* this equation is first order because of the  term

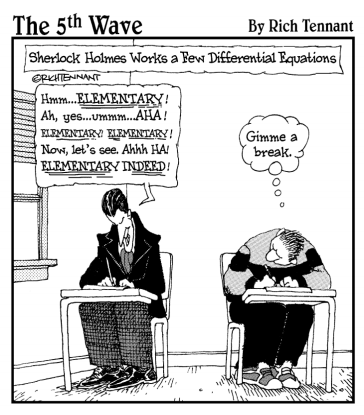
*y*″  *y*′  12*y* = 0 this equation is second order because of the *y*″ term.

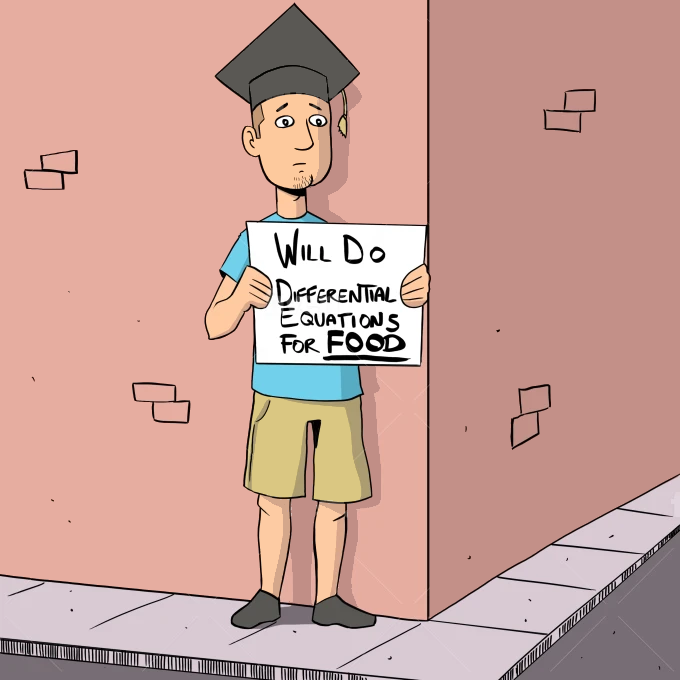
The second-order equation is used in the science of radio communications

In a circuit of order *n*, these differential equations have order *n*

The number and configuration of the energy storage elements determines the order of the circuit: *n* ≤ # of energy storage elements

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